

What is claimed is:

- 1. A retainer for a ball bearing formed in a generally annular shape and having a plurality of pockets arranged in a circumferential direction to rollably hold a plurality of balls along a pitch circle, respectively, the pockets each having an opening on outer and inner sides in the radial direction of the retainer, the balls having a diameter and a rolling surface, the pockets each having an inner peripheral surface comprising a radially inner section which is located inward of the pitch circle of the balls in the radial direction of the retainer, and has an inner diameter larger than the diameter of the balls, such that the gap between the radially inner section of the inner peripheral surface of the pockets and the rolling surface of the balls gradually increases toward the opening of the pockets on the inner side in the radial direction of the retainer, and that the maximum inscribing circle with respect to the opening of the pockets on the outer side in the radial direction of the retainer has a diameter smaller than the diameter of the balls.**
- 2. A retainer for a ball bearing formed in a generally annular shape and having a plurality of pockets arranged in a circumferential direction to rollably hold a plurality of balls, respectively, the balls having a rolling surface having a radius of curvature, the pockets each having an inner peripheral surface formed in a**

spherical concave shape having a radius of curvature slightly larger than the radius of curvature of the rolling surface of the balls, such that part of the inner peripheral surface of the pockets coming in contact with the rolling surface of the balls rolling in the pockets is formed with a recess reaching at least the inner periphery of the retainer.

3. The retainer of one of Claims 1 and 2, wherein the retainer is of the crown type, and comprises an annular main portion and a plurality of elastic pieces provided on one side in the axial direction of the annular main portion to define a pocket between a pair of the circumferentially adjacent ones of the resilient pieces, such that the main portion and elastic pieces define an inner peripheral surface which is formed in a partial conical concave shape that is inclined such that the diameter of the inner peripheral surface closer to the tip ends of the resilient pieces is larger than the diameter of the inner peripheral surface closer to the other side in the axial direction of the annular main portion.

4. A ball bearing comprising an inner race having an outer peripheral surface formed with an inner-race track, an outer race having an inner peripheral surface formed with an outer-race track, such that a space is formed between the outer peripheral surface of the inner race and the inner peripheral surface of the outer

race, a plurality of balls rollably provided between the inner-race track and the outer-race track in the space, a retainer of one of Claims 1 to 3 for rollably holding the balls arranged with an interval in the circumferential direction, and a pair of seal plates having an outer peripheral edge attached to the inner peripheral surface of the outer race at the opposite axial ends of the other race, respectively, and an inner peripheral edge provided close to or in sliding contact with the outer peripheral surface of the inner race at the opposite axial ends of the inner race, such that the openings at the axially opposite ends of the space are blocked by the pair of the seal plates.

5. A rolling bearing comprising an inner race having an outer peripheral surface formed with an inner-race track and a seal groove formed in the outer peripheral surface at an axial end thereof, the seal groove having a wall surface and a bottom, an outer race having an inner peripheral surface formed with an outer-race track and a seal groove formed at an axial end thereof, such that a space is formed between the outer peripheral surface of the inner race and the inner peripheral surface of the outer race, a plurality of rolling elements rollably provided between the inner-race track and the outer-race track in the space, and a seal plate formed in a generally annular shape, comprising an elastic member and a core metal for

reinforcing, and having an outer peripheral edge fitted in the seal groove generally in the inner peripheral surface of the outer race and an inner peripheral edge defined by the end edge of the elastic member in sliding contact with the wall surface of the seal groove in the outer peripheral surface, the end edge of the elastic member comprising an inclined side surface opposing the wall surface of the seal groove, an inner peripheral surface located radially inward of the inclined side surface and opposing the bottom of the seal groove, and a continuation portion for continuously connecting the inclined side surface with the inner peripheral surface of the end edge, the continuation portion being in sliding contact with the wall surface of the seal groove, the angle between the wall surface of the seal groove and the inclined side surface of the end edge being in the range from 10 degrees to 45 degree in this state where continuation portion is in contact with the wall surface, the bottom of the seal groove being in parallel to the inner peripheral surface of the seal groove or being inclined relative to the inner peripheral surface of the end edge such that the gap between the bottom of the seal groove and the inner peripheral surface of the end edge increases toward the axially outer end of the inner race, and the angle between the bottom of the seal groove and the inner peripheral surface of the end edge being in the range from 0

degrees to 30 degrees.

6. The rolling bearing of Claim 5, wherein the continuation portion is formed in a curved surface of an arc shape in cross section.

7. The rolling bearing of one of Claims 5 and 6, wherein the rolling elements are balls, and provided that L is an interference in the axial direction of the end edge of the elastic member with respect to the wall surface of the seal groove, and P is the force for pressing the end edge of the elastic member on the wall surface based on the rigidity of the seal plate, P/L is in the range from 2.9 N/mm to 9.8 N/mm, and L is in the range from 1% to 3% of the diameter of the balls.

8. A ball bearing comprising an inner race having an outer peripheral surface formed with an inner-race track, an outer race having an inner peripheral surface formed with an outer-race track, a plurality of balls rollably provided between the inner-race track and the outer-race track, a retainer for rollably holding the balls, the retainer having a surface on one axial side thereof and inner and outer peripheral surfaces, and a seal plate opposing the surface on the one axial side of the retainer and having a surface on one axial side thereof and an outer peripheral edge attached to the inner peripheral surface of the outer race at an axial end of the outer race and an inner peripheral edge in sliding contact with or close to the outer

peripheral surface at an axial end of the inner race, the outer peripheral surface of the inner race having a radially inner shoulder portion adjacent the axially outer side of the inner-race track and having a diameter larger than the inner-race track so as to face the inner peripheral surface of the retainer such that a radially inner annular gap with a radial size is formed between the radially inner shoulder portion and the inner peripheral surface of the retainer, an annular gap being formed between the surface on the one axial side of the retainer and the surface on the one axial side of the seal plate, the inner peripheral surface of the outer race having a radially outer shoulder portion adjacent the axially outer side of the outer-race track and having a diameter smaller than the outer-race track so as to face the outer peripheral surface of the retainer such that a radially outer annular gap with a radial size is formed between the radially outer shoulder portion and the outer peripheral surface of the retainer, the annular gap between the surface on the one axial side of the retainer and the surface on the one axial side of the seal plate having a size at its inner periphery and an axial size at its radially middle portion, wherein provided that L_1 is the radial size of the radially inner annular gap, that the L_2 is the size of the annular gap at the inner periphery thereof, that L_3 is the axial size at a radially middle portion of the annular gap, that L_4 is the radial size of the

radially outer annular gap, and that D_4 is the diameter of the balls, the following relations are satisfied;

$$L_1 \leq L_2 \leq L_3,$$

$$1.5L_1 \leq L_3 \text{ or } 0.09D_4 \leq L_3, \text{ and}$$

$$L_1 \leq L_4.$$

9. A ball bearing comprising an inner race having an outer peripheral surface formed with an inner-race track, an outer race having an inner peripheral surface formed with an outer-race track, a plurality of balls rollably provided between the inner-race track and the outer-race track, a retainer for rollably holding the balls, the cage having a surface on one axial side thereof and a seal plate opposing the surface on the one axial side of the retainer and having an outer peripheral edge attached to the inner peripheral surface of the outer race at an axial end thereof and an inner peripheral edge in sliding contact with or close to the outer peripheral surface at the axial end of the inner race, a radially inner shoulder portion provided on the outer peripheral surface of the inner race adjacent the axially outer side of the inner-race track and having an outer peripheral surface and a diameter larger than the inner-race track, and a seal groove provided on the outer peripheral surface of the inner race adjacent the axially outer side of the radially inner shoulder portion and having an axially inner wall surface, wherein provided that a

first line extends from the outer peripheral surface of the radially inner shoulder portion in the cross sectional view including the central axis of the inner race and the outer race, and that a second line extends from the axially inner wall surface of the seal groove in the cross sectional view including the central axis of the inner race and the outer race so as to cross the first line at an intersection, the intersection is not located inside of the surface on one axial side of the retainer with respect to the axial direction of the inner race and retainer.

10. The ball bearing of Claim 9, wherein the retainer is of the crown type, and comprises an annular main portion having a surface on one axial side thereof and a plurality of elastic pieces provided on the surface on the one axial side of the annular main portion, and the inner-race track and outer-race track and balls are displaced more remote from the main portion than the axially central portion of the inner race and outer race.

11. A ball bearing comprising an inner race having an outer peripheral surface formed with an inner-race track, an outer race having an inner peripheral surface formed with an outer-race track, a plurality of balls rollably provided between the inner-race track and the outer-race track, a retainer for rollably holding the balls, the retainer having a surface on one axial side thereof and a seal plate opposing the

surface on the one axial side of the retainer and having an outer peripheral edge attached to the inner peripheral surface of the outer race at an axial end thereof and an inner peripheral edge in sliding contact with or close to the outer peripheral surface at the axial end of the inner race, a radially inner shoulder portion provided on the outer peripheral surface of the inner race adjacent the axially outer side of the inner-race track and having a diameter larger than the inner-race track so as to face the inner peripheral surface of the retainer, such that a radially inner annular gap with a radial size is formed between the radially inner shoulder portion and the inner peripheral surface of the retainer, and the seal plate having an end edge adjacent the inner peripheral edge thereof, wherein provided that L_1 is the radial size of the radially inner annular gap, that a first line extends from the outer peripheral surface of the radially inner shoulder portion in the cross sectional view including the central axis of the inner race and the outer race, and that a second line extends from the axially inner wall surface of the seal groove in the cross sectional view including the central axis of the inner race and the outer race so as to cross the first line at an intersection, that the end edge of the seal plate adjacent the inner peripheral edge thereof is the closest to the intersection, a gap is provided between the intersection and the end edge of the seal plate to have a size L_5 in the range of $0.5L_1 \leq L_5 \leq L_1$ in the axial direction of the inner race and seal plate.